# EU Commission Horizon2020 Secure Societies Work Program

**Call: SECURITY: Border and External Security**

**Topic:** SU-BES03-2018-2019-2020 Sub Topic 3

**Title**: Improved systems for the vessel tracking, behaviour analysis and automatic anomaly detection

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# Project Acronym: TIDE – Territorial Integrity in the Data Era

**Partner Requirements:**

We are looking for collaboration partners to join this consortium which currently includes SiriusInsight and the Edinburgh Centre for Robotics (the UK national centre for excellence focusing on Robotics and Autonomous Systems technology); in particular we are seeking Civil Authorities within the maritime domain as per the criteria of the call. Other industrial or academic partners are also welcome, in particular focussing on sensors including radar, optical and passive signal detection.

**Introduction:**

1. The cost of illicit drug use, smuggling and illegal migration in Europe is over €40Bn per annum, Europe has the world's largest maritime coastline at over 70,000 kms and most drugs, contraband and people arrive by sea through porous maritime borders. **Maritime situational awareness** is critical to territorial integrity, safety and prosperity, however, the maritime environment is highly complex and incomparably difficult to operate in. Currently, Europe's coastline, territorial waters and approaches are sparsely monitored and largely reliant on self-reporting by vessels; there is no persistent surveillance, radar, lookouts or alerting of large swathes of territorial waters; and response assets are expensive, scarce and uncoordinated; traditional surveillance methods are inadequate at best. ***Europe's coastal border is extremely vulnerable to exploitation, threatening sovereignty, prosperity, safety and security.***

2. A UK based marine analytics company, SiriusInsight.AI can deliver exponentially enhanced coverage, capability and cost saving to current maritime surveillance efforts, through application of vessel profiling, behaviorial analytics and a fusion of multiple data from vessel transponders, satellite imagery and a proposed network of low cost, interconnected, autonomous shore- and sea-based sensor systems deployed at scale, along any coastline. These sensors, currently piloted in the Dover Straits, deliver alerts from radar, optical detection, radio emissions, weather and environmental monitoring at scale along our coastlines and enable the monitoring of vessels without transponders.

3. SiriusInsight is proposing to deliver a Horizon2020-funded programme, collaborating with 3 EU-member agencies to deliver a pilot demonstrating the application of advanced artificial intelligence with low-cost data to transform efficiency of interdiction operations. SiriusInsight brings together extensive maritime domain knowledge and state-of-art big data and artificial intelligence, to enable 'pattern of life' analysis to identify suspicious activity and facilitate interception.

**Current capability and methodology**

4. Approximately 15% of European waters are monitored on a persistent basis and are largely reliant on vessels self-reporting, whilst surveillance is derived from costly, patchy and non-persistent sources. Most surveillance is reliant on self-transmitted vessel transponders, occasionally validated by very expensive aerial imagery. Data comes together in command centres but with negligible fusion or analysis, and is routinely presented in differing formats, resulting in a disjointed deluge of data rather than actionable information. Similar data has multiple applications across nations and agencies but it is seldom shared.

**SiriusInsight's Proposal - the vision**

5. SiriusInsight analyses over 40 million 'Automatic Identification System' (AIS) reports from ships daily, tracking over 180,000 vessels globally; this is fused with satellite imagery, delivering an approximate 90% picture of global shipping and availability of historic data up to 5 years old. From persistent analysis of regions or vessels, we produce vessel **profiles** incorporating structured/ unstructured data; these are also informed by other data relating to economic performance, operating standards, vessel ownership and management, trading areas and utilisation. Operations within certain areas of interest eg. known drug processing or smuggling ports, is also factored. Machine learned, AI-derived analysis then creates precise, application specific alerts for anomalous behaviour, eg. potential drug transportation from South America, and a risk rating for each vessel.

6. Intelligent analysis of AIS transmissions, incorporating AI-derived areas of poor reception and informed validation of signal, is also used to **alert unusual activity**. The inherent weakness of relying on AIS signals (self-transmitted and easy to interrupt) is addressed by continual, low-cost report validation through computer vision of satelite imagery (radar and optical); 'Dark Vessels' (not reporting on AIS) and 'profile-alerted vessels' are therefore highlighted.

7. As vessels, of any size, approach our / european shores, our future concept of inter-connected, overlapping, controlled and autonomous sensors, would enable complete and persistent coverage of territorial waters and the approaches, generating alerts and providing a search, tracking, cueing or evidence gathering capability, and enabling optimal management and cueing of response assets. This brings forward the ability to validate vessels as they approach and transit relevant waters, incorporating optical, radar and radio transmission detection – which enable smaller vessels detection, and complement AIS reporting. Scalable and adjustable, the network can provide coverage of open water or inland waterways, ports and approaches.

8. Producing actionable analytics is only possible with pioneering AI algorithms 'at the edge', enabling huge volumes of position information and correlating imagery to be automatically fused and to deliver time critical alerts. Combining this behavioural analysis with deep domain expertise, this derived product delivers the opportunity to revolutionise existing methodology. This 'sea truth' data and analysis is deliverable into any existing infrastructure for visualisation, action and dissemination. Prototypes of the automated sensors, deployed on land and at sea for several months in the English channel, have already demonstrated SiriusInsight's ability to augment existing capabilities by delivering live data and alerts into 3rd party systems and environments.

**Why SiriusInsight**

9. SiriusInsight unites the latest academic advances in Artificial Intelligence, with mariners with over 100 years of maritime operational expertise in its executive team. The Advisory Board includes the previous UK Minister for Science and Universities, NATO's previous Maritime Commander, and the Chair Professor of Informatics at King's College London. Our solutions are implementation and end-user agnostic; our algorithms, AI and Machine Learning are adaptable and scalable to requirement, and risk 'labels' are adjustable according to risk measurements and anomalies. We are working with two other Universities to enhance 'at the edge' processing, remote operation, pattern of life alerting, multi-sensor fusion and power management, all of which assist with further improving the challenge of voluminous data management and timely action alerting.

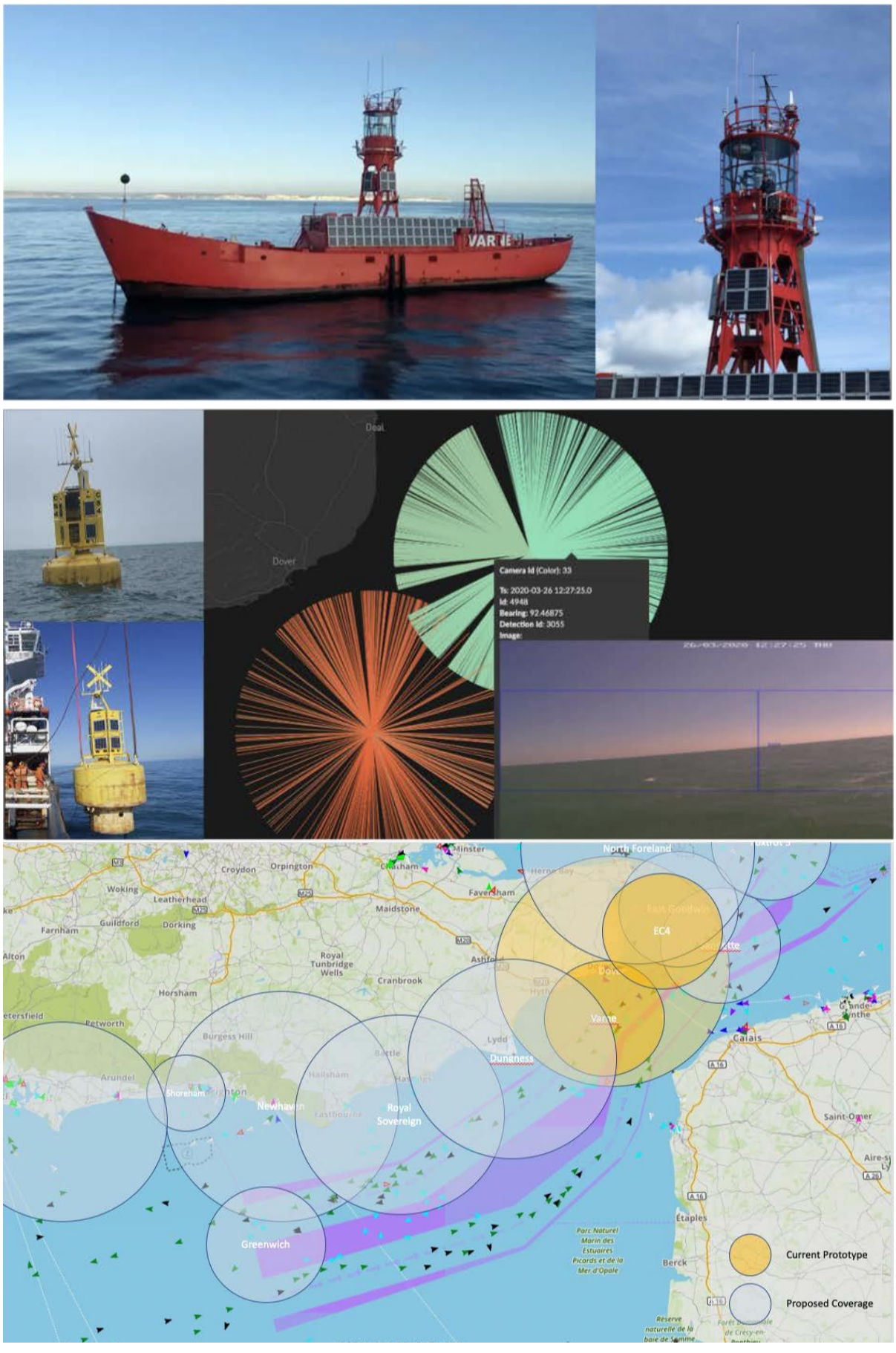
10. There are 6 key reasons why better surveillance and data gathering is in Europe's interests: a **single solution for multiple agency application**, eg. migration, counter-terrorism, drugs, fishery protection, environmental and safety, delivering **Sovereign territorial integrity**; with **cost** and **inefficiency** facilitating international **and inter-agency interoperability**, and **evidence gathering**.

11. SiriusInsight's solution is extremely low cost, efficient, agile, rapid and carbon-neutral. A prototype has already been demonstrated within the UK's Accelerated Capability Environment (ACE) for The Office for Security & Counter-Terrorism, the Minsitry of Defence, the National Maritime Information Centre and other key stakeholders, and has received unequivocal support and recognition

of the immediate value, particularly of alerting and pattern-of-life analytics informed by low-latency, high coverage, low-cost data.

**Summary**

12. The final-phase of confirmed UK participation in the EU's Horizon2020 programme includes a theme focussed on "Improved systems for the vessel tracking, behaviour analysis and automatic anomaly detection". The call provides for two €5m costed projects from within member nations, with collaboration from at least 3 EU 'Border Force' agencies. SiriusInsight has identified academic and commercial partners to deliver this programme, and is seeking UK Border Force or HM Revenue & Customs support to launch the programme.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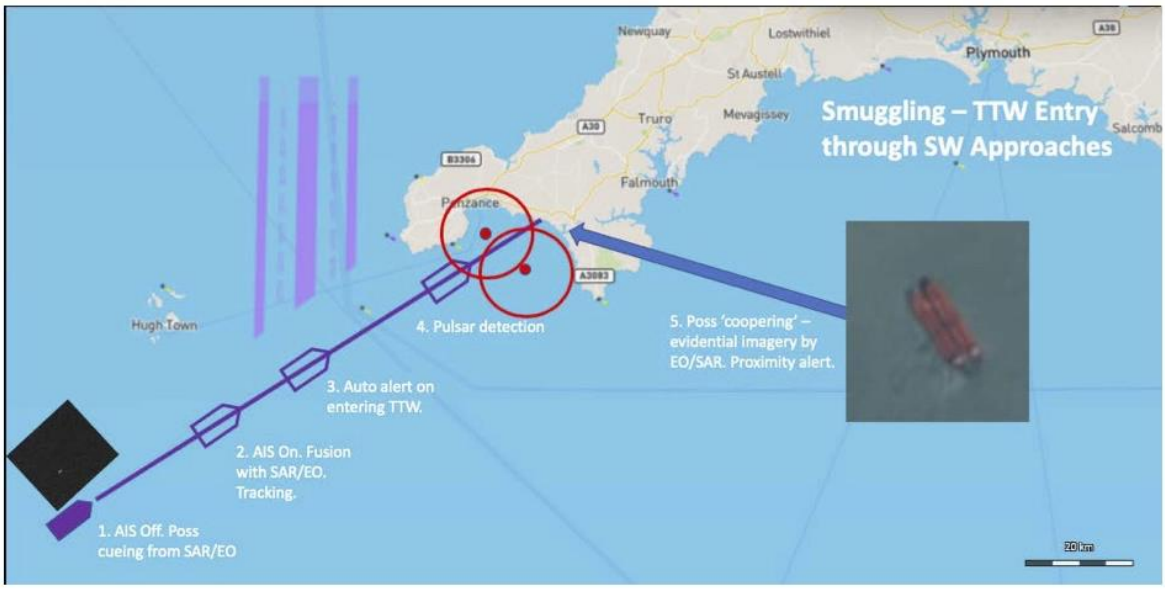
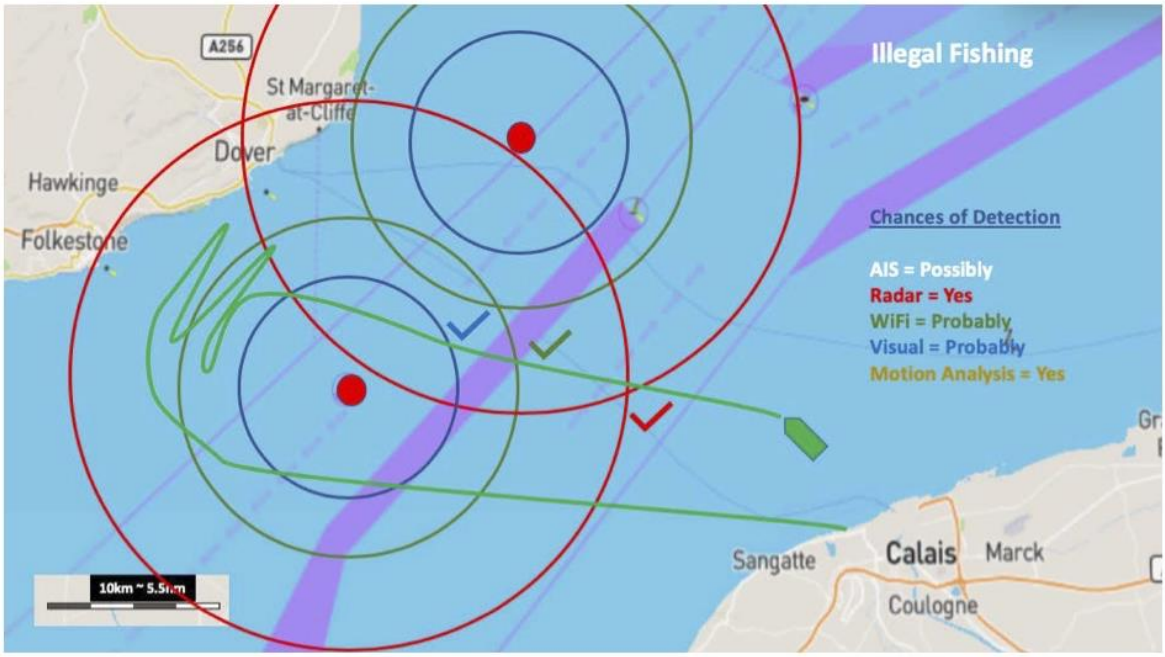
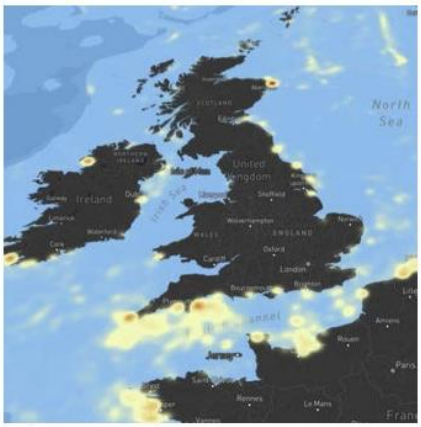
Current Prototype
Proposed Coverage




Tanker movement in UK



Fishing Vessel activity UK